

FLORA OF CALCAREOUS UPLAND GLADES IN GADSDEN AND JACKSON COUNTIES, FLORIDA¹

A.F. Johnson

Florida Natural Areas Inventory
1018 Thomasville Road, Suite 200-C
Tallahassee, Florida 32303, U.S.A.
ajohnson@fnai.org

L.C. Anderson

Emeritus, Department of Biological Science
Florida State University
Tallahassee, Florida 32306, U.S.A.
anderson@bio.fsu.edu

W.W. Baker

1422 Crestview Ave.
Tallahassee, Florida 32303, U.S.A.

A.K. Gholson, Jr.

P.O. Box 385
Chattahoochee, Florida 32324, U.S.A.

ABSTRACT

A total of 302 vascular plant species and nine non-vascular species were noted between 2005 and 2012 on 21 small herbaceous openings known as "Florida upland glades" on thin soil over calcareous outcrops in Jackson and Gadsden counties, Florida. While these openings are dominated by grasses found on many other calcareous glades and prairies in the Southeast (e.g., *Schizachyrium scoparium*, *Sporobolus vaginiflorus*, *Muhlenbergia capillaris*), they are also unique in being characterized by the dominance of a sedge, *Schoenus nigricans*, which is absent from such openings in other states. Two-hundred and eighty of the 302 vascular species noted are native and 14 are listed as endangered by the state of Florida. One moss new to Florida (*Pleurochaete luteola*) and one probable new taxon of *Coreopsis* are reported from these glades. Between 32 and 49 percent of the native vascular species on Florida upland glades are shared with calcareous glades and prairies to the north and west from Georgia to Texas. Only three of the smaller Florida upland glades are currently protected on public land. The seven remaining larger intact glades are urgently in need of protection, either by public acquisition or conservation easements.

RESUMEN

Se anotaron un total de 302 especies plantas vasculares y nueve especies de no-vasculares entre 2005 y 2012 en 21 pequeños claros herbáceos conocidos como "Florida upland glades" sobre suelos someros en afloramientos calcáreos en los condados de Jackson y Gadsden, Florida. Mientras que estos claros están dominados por gramíneas que se encuentran en muchos otros pastizales calcáreos del sureste (ej., *Schizachyrium scoparium*, *Sporobolus vaginiflorus*, *Muhlenbergia capillaris*), son también únicos por estar caracterizados por la dominancia de la ciperácea, *Schoenus nigricans*, que está ausente en los claros d otros estados. Doscientos ochenta de las- 302 especies vasculares son nativas y 14 están listadas como amenazadas para el estado de Florida. Se citan un nuevo musgo para Florida (*Pleurochaete luteola*) y un probable nuevo taxon de *Coreopsis*. Entre el 32 y el 49 por ciento de las especies vasculares nativas de los "Florida upland glades" se comparten con praderas del norte y oeste desde Georgia hasta Texas. Solo tres de los más pequeños "Florida upland glades" están protegidos actualmente en suelos públicos. Los siete restantes más grandes intactos necesitan protección urgentemente ya sea por adquisición pública, o por decretos de conservación.

INTRODUCTION

Florida upland glades are small (0.03 to 0.8 ha), largely herbaceous openings in an otherwise forested landscape, occurring on thin soils over calcareous substrates in dissected terrain in Jackson and Gadsden counties (plus one just north of the border in Decatur County, Georgia). They form the southeastern outpost of a series of calcareous prairies and glades in the southeastern U.S., stretching from eastern Texas north to southern Ohio and east to Georgia (Fig. 1). These isolated prairies and glades surrounded by forest are dominated on the deeper soils by some of the same grasses as the Midwestern tallgrass prairies (*Schizachyrium scoparium*, *Andropogon gerardii*, *Sorghastrum nutans* and *Panicum virgatum*; Sims 1988). Areas of shallower soil over calcareous substrates are characterized by the annual grass, *Sporobolus vaginiflorus* (Ware 2002; Lawless et al. 2006). While Florida upland glades share none of the endemic species of these calcareous openings to the north and west, they do have many species in common with them, including some of the same dominant grasses

¹We dedicate this paper to Steven W. Leonard, who in 1982 brought attention to new glades, new Florida species, and a rare plant community in Florida.

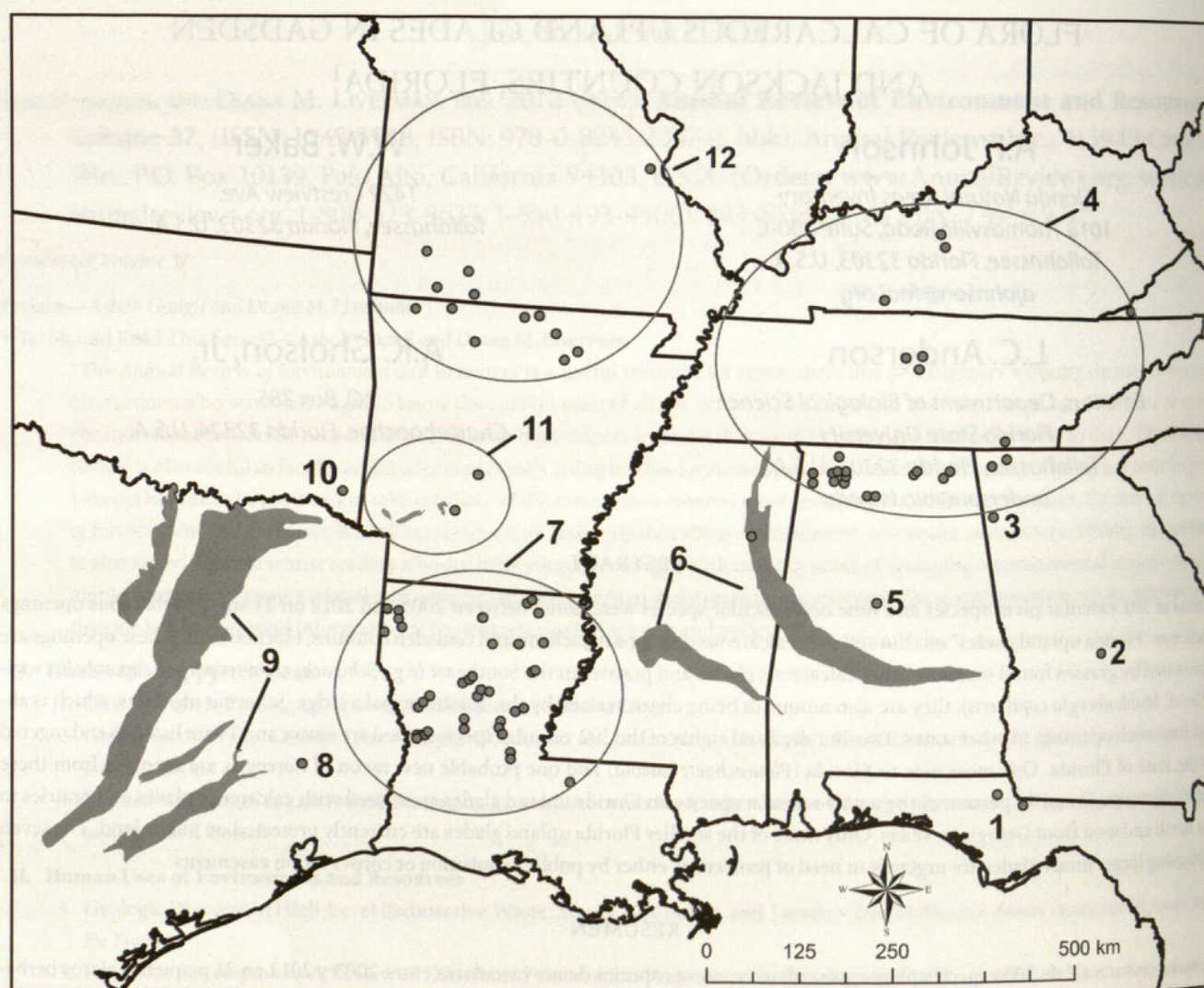


FIG. 1. Calcareous prairies and glades in the Southeastern U.S (map modified from Fig. 1.1 in Peacock & Schauwecker 2003). Filled polygons in MS, AL, and TX and points in LA represent the historical (vs. current) extent of blackland prairies in those areas. 1. Florida Upland Glades. 2. Oaky Woods Wildlife Management Area (Echols & Zomlefer 2010). 3. Coosa Valley Prairies (Ware 2008; Natureserve 2012). 4. Tennessee and related glades (Baskin & Baskin 2003). 5. Ketona Dolomite Glades (Allison & Stevens 2001). 6. Blackbelt Prairies of Mississippi and Alabama (Barone & Hill 2007; Schotz & Barbour 2009; Schotz 2011; Campbell & Seymour 2012). 7. Louisiana Blackland Prairies (MacRoberts & MacRoberts 1995, 1996; MacRoberts et al. 2003). 8. Windham Prairie (Brown et al. 2002). 9. Texas Blackland Prairies (Diamond & Smeins 1985). 10. Weches Formation Glades (White & Arbour 2012). 11. Blackland Prairies of Southwest Arkansas (Foti 1989; Zollner et al. 2003). 12. Missouri and Arkansas Ozarks (Erickson et al. 1942; Kucera & Clark 1957; Nelson & Ladd 1980). (Not shown due to spatial limitations are xeric limestone prairies [Lawless et al. 2006], which are found in three areas: within circles 4 and 12 and just north of the KY border into extreme southern OH, IN, and IL.)

(*Schizachyrium scoparium*, *Muhlenbergia capillaris*, and *Sporobolus vaginiflorus*; Baskin and Baskin 2003). However, the Florida glades are also unique in having as one of their most characteristic dominants, the sedge *Schoenus nigricans*, which is not found at any of the other sites shown in Figure 1.

These graminoid-dominated openings on calcareous outcrops have traditionally been referred to as “glades” in Florida (or “upland glades” to distinguish them from the Florida Everglades). Baskin and Baskin (2000) and Lawless et al. (2004) suggest confining the term “limestone cedar glade” to sites dominated by annual C_4 grasses, cryptogams, and winter annuals, while using “xeric limestone prairies” and “barrens” to denote areas dominated by perennial grasses, in part because the two types have different endemics and different implications for management. Limestone cedar glades are naturally open due to shallow substrates, whereas prairies and barrens require anthropogenic fire to maintain them in open condition. However, the Florida areas have about equal proportions of the dominant annual and perennial grasses cited by the above authors and, in addition, a dominant perennial sedge whose relationship to soil depth has not been determined. In light of

their uniqueness, we will refer to them here as "Florida upland glades" as distinct from "limestone cedar glades" sensu Lawless et al. (2004). Florida upland glades are denoted as "panhandle Florida limestone prairie" by NatureServe (2012) at their association level of vegetation classification.

Florida upland glades were first recognized as a distinct community by Gholson (Ward & Gholson 1987) who began collecting specimens from River Junction and East Bank Campground glades in the 1970's (including the first examples from glades of species that are rare in Florida, e.g., *Delphinium carolinianum*, *Ratibida pinnata*, and *Symphyotrichum pratense*). The idea of Florida upland glades as a distinct community was bolstered in 1982, when, as part of a systematic survey of habitats and rare species along the east side of the Apalachicola River, Leonard and Baker (1982) discovered five more upland glades in Gadsden County with four species new to Florida (*Asclepias viridiflora*, *Echinacea purpurea*, *Stachys crenata*, and *Symphyotrichum shortii*) and one new to the Apalachicola region (*Callirhoe papaver*). Continued collecting by Gholson, J.B. Nelson, R.K. Godfrey, and others on these upland glades, as well as on some in Jackson County, resulted in the finding of more rare species, range extensions, and species new to Florida (including *Primula meadia*, *Salvia urticifolia*, and *Sporobolus vaginiflorus*; Anderson [1984, 1988, 1989, 2007]). Other publications reported the finding of individual species new to Florida, including *Bouteloua curtipendula* (Nelson 1985), *Lepuropetalon spathulatum* (Ward & Gholson 1987), and *Carex microdonta* (Bridges et al. 1989) and included short descriptions of the glades vegetation, with the result that the current list of known rare species from the Florida upland glades was fairly complete by the end of the 1980s. In 1987 Nelson, Anderson, and Gholson compiled a preliminary species list for the Gadsden County glades which was updated by Gholson in 1990. The present paper builds on the preliminary list for the Gadsden County glades, adds species from the Jackson County glades, and places the flora of the Florida upland glades in the context of other well-studied calcareous glades and prairies to the north and west. It is hoped this publication will spur recognition of the biogeographical significance of the Florida upland glades and lead to protection of at least some of the better preserved examples.

PHYSICAL SETTING

Geology

Florida upland glades occur in two clusters about 40 km apart. The cluster of eleven Gadsden County glades (plus a twelfth glade just over the border in Georgia, which will hereafter be included with the Gadsden County glades) are scattered within a 47 km² area north, south, and southeast of the town of Chattahoochee along the uplands bordering the eastern side of the Apalachicola River (Fig. 2). They occur at an elevation of 27.4–30.5 m above mean sea level (90–100 ft contour line) and are underlain by the Chattahoochee Formation of lower Miocene age, a silty, sandy dolomite with occasional occurrences of limestone, which dips steeply southward from a high point in the vicinity of Chattahoochee (Rupert 1990). The cluster of nine Jackson County glades are scattered within a 10 km² area west and northwest of the town of Marianna (Fig. 3). They occur between the 140- and 150-ft contour lines and are underlain by Marianna Limestone of lower Oligocene age, a white to light gray limestone 7.6–12.2 m thick which dips southward from a maximum elevation above mean sea level near Marianna of 45.7 m (150 ft; Moore 1955). The Marianna is a commercial grade limestone that is being actively mined in the vicinity of the glades.

Soils

Coultas (1983) sampled soils along transects across three glades in Gadsden County, with a total of 13 samples from open glades and 6 samples from forested edges of glades. Depth to hard limestone on the herb-dominated open glades ranged from 10 to 36 cm; on the forested edge of the glades it ranged from 53 to >152 cm. Soil texture on the open glades was generally silt loam in the upper layers, followed by several inches of soft limestone grading to hard limestone. On the forested edges, sandy loam in the upper layers gave way to clay and then to soft limestone followed by hard limestone. The open glades soils were more alkaline (pH 7.5) than the soils of the surrounding forests (pH ranging from 5.3 to 6.4). Coultas concludes from the lack of mottling in the subsoil of the open glades and the position of one of the sampled glades (#5 on Fig. 2) at the crest of a hill that they are not seepage areas and that woody invasion is probably controlled by the shallowness of the soils.

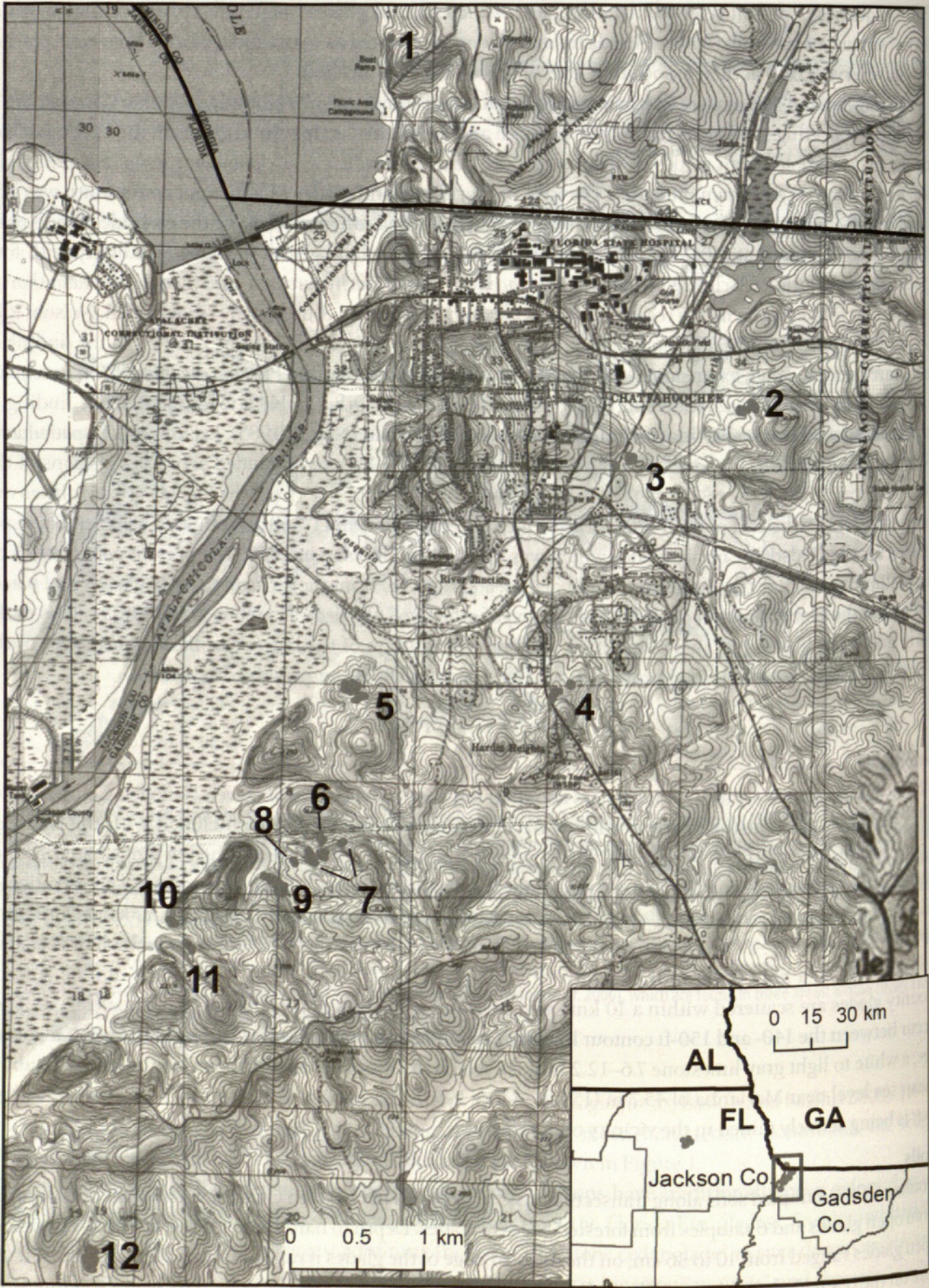


FIG. 2. Location of Gadsden County Glades. 1. East Bank Campground; 2. PRIDE; 3. Railroad; 4. River Junction; 5. Brickyard; 6. Powerline; 7. EB; 8. Selway Line; 9. Chalky; 10. Aster Shortii; 11. Snake; 12. Humphrey.

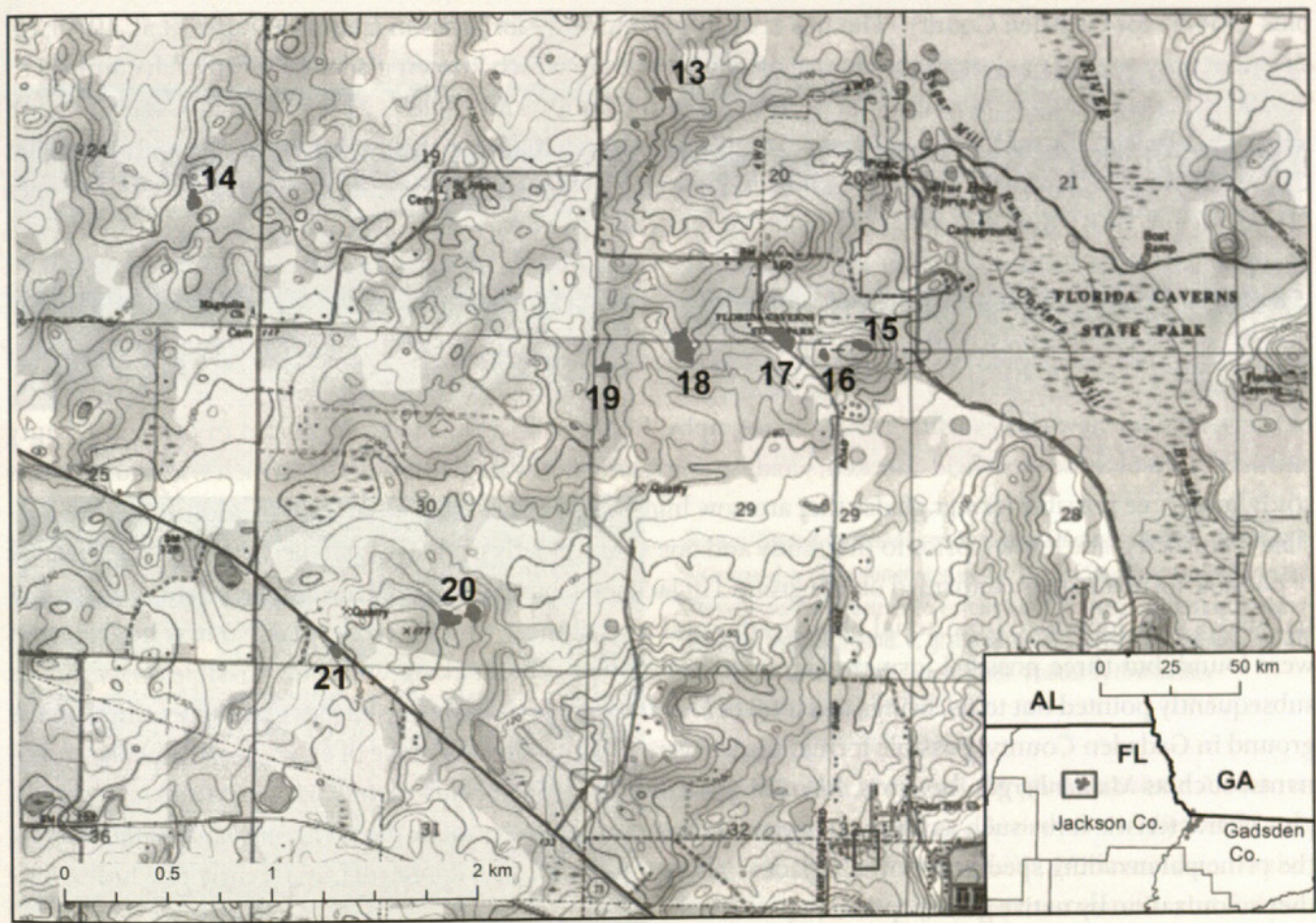


Fig. 3. Location of Jackson County Glades. 13. Old Car; 14. Williams-2; 15. Moranz; 16. Bennett; 17. Bumpnose; 18. Brooks-1; 19. Brooks-4; 20. Brooks-2; 21. West of SR 73.

Climate

The area experiences mild winters and hot summers, with rainfall evenly distributed throughout the year. Mean daily maximum and minimum temperatures at Marianna are 18.2 and 5.24°C in January and 32.9 and 21.4°C in July; mean annual rainfall is 140.6 cm (Weather-Warehouse 2012). The average length of the growing season ranges from 260 to 280 days. Short drought periods occur most commonly in April and from September through November (Fernald & Purdum 1992).

METHODS

Twenty of the 21 glades were visited by the authors at least once in spring (March–June) and once in fall (September–November) between 2005 and 2012, and most were visited multiple times throughout the growing season. The exception was Snake glade, which was destroyed by road widening sometime between 1985 and 2005. Records for this glade are from four visits by Baker and Gholson in the 1980s. At each visit, species checklists were made and voucher specimens collected. Plants were listed from the open glade, from the edges, including the shrub zone between the open glade and the forested area around it, or the forest edge within 10 m of the open glade, if no shrub zone was present. Common non-vascular plant taxa and ground lichens were also noted, but no attempt was made to compile an exhaustive list of these taxa. Once a relatively complete list of vascular plant species was developed, the Angus Gholson herbarium (formerly AKG, now part of FLAS) and R.K. Godfrey herbarium (FSU) were searched for specimens from the glades to serve as further vouchers.

In 2005 one new glade was found and this spurred a systematic search of aerial photographs to identify potential new glades in the vicinity of known glades. Criteria used to distinguish glades openings from clearings were: (1) sites that remained open on all aerial dates consulted; i.e., 2004, 1999, 1994 for both counties,

plus 1954-55 for Gadsden County (Thomas et al. 1961) and 1969 for Jackson County (Duffee et al. 1979); (2) sites that were within or close to the elevation contour lines in which known glades occur in each county, i.e., 90-100 ft in Gadsden county and 140-150 ft in Jackson County; and (3) sites that had soils associated with known glades and/ or rock outcrop symbols on the soil survey maps for the respective counties. In Gadsden County these were Binnsville soils or Cuthbert, Boswell and Susquehanna soils on moderate to steep slopes (Thomas et al. 1961). In Jackson County, soils were the Oktibbeha variant rock outcrop complex (Duffee et al. 1979).

RESULTS AND DISCUSSION

New glades

In the search for new glades using aerial photography, fifty-one openings were identified in Jackson County and seventeen of these were field checked, yielding one relatively intact glade, Old Car, which was added to this study, and three possible former glades that are now highly disturbed. The latter three, in addition to one possible disturbed glade known prior to this study and one subsequently pointed out to us, brings to five the total of possible former glades confirmed on the ground in Jackson County. In Gadsden County, twenty-two potential glades were identified from aerial photography and nine of these were field checked. No new intact glades were found, but three possible former glades were identified, which, along with one possible former glade subsequently pointed out to us, brings to a total of four the number of possible former glades identified on the ground in Gadsden County. Possible former glades were identified by presence of characteristic glades dominants, such as *Muhlenbergia capillaris*, *Rhynchospora divergens*, *Sporobolus vaginiflorus*, or *Stenaria nigricans*, plus characteristic forbs such as *Polygala boykinii*. The non-native centipede grass (*Eremochloa ophiuroides*) is the principal invading species on former glades, where it often forms a dense turf, apparently precluding further colonization by native glades species.

In addition to the larger graminoid-dominated glades, small glade-like openings in forested areas with some of the characteristic glades forbs are known from four areas: Three Rivers State Park in Jackson County, the Angus Gholson Nature Park in Chattahoochee, an area along the Florida-Georgia line north of Chattahoochee, and an area known as "Brooks-3" west of Marianna in Jackson County.

Vegetation

Vegetation of the twenty-one glades consists of an open graminoid-dominated portion bordered by a characteristic set of calciphile shrubs and small trees that grade into the surrounding forest matrix on deeper soils (Fig. 4a-b). These shrubs and small trees may also form clumps or islands on the open glade. The surrounding forests (where still intact) consist of mesic upland hardwood forests on the steeper lower slopes, and pine-oak-hickory forests, or, in a few cases, remnants of longleaf pine/wiregrass pinelands, on the gentler upper slopes.

Juniperus virginiana is the predominant woody species found on the open glades and on the edges. Other shrubs and small trees consistently present on the edges of most glades are *Celtis laevigata*, *Cercis canadensis*, *Cornus asperifolia*, *Fraxinus americana*, *Ilex vomitoria*, *Myrica cerifera*, *Rhamnus caroliniana*, *Sideroxylon lanuginosum*, *S. reclinatum*, and *Viburnum rufidulum*. There is some differentiation between the two counties in common woody species found on the glades. *Acer saccharum* ssp. *floridanum* is more common in Gadsden County and *Quercus muhlenbergii* is more common in Jackson County. *Crataegus spathulata*, *C. pulcherrima*, and *Ulmus alata* are found on glades only in Gadsden County.

Dominant species of the herbaceous portion vary from glade to glade and from place to place within a glade. *Schoenus nigricans*, a large, clump-forming sedge, forms dense, nearly monospecific stands at sixteen of the twenty-one glades studied (Fig. 4a). Other large graminoids dominating portions of glades are *Muhlenbergia capillaris*, *Sporobolus junceus*, and *Schizachyrium scoparium*. A short turf composed of *Sporobolus vaginiflorus* and/or *Rhynchospora divergens* (Fig. 4b) is often found on other portions of the glades. Additional small grasses commonly found on the glades include *Aristida longispica*, *A. oligantha*, *Sporobolus clandestinus*, *Schizachyrium tenerum*, and *Panicum flexile*. Areas with much bare soil or broken rock at the surface support *Stenaria nigricans*, along with the moss *Weissia jamaicense* and a cyanobacterium, *Nostoc* sp. Characteristic



FIG. 4. a. Glade dominated by pure stand of *Schoenus nigricans*, flowering in foreground. b. glade dominated by short turf of *Sporobolus vaginiflorus* and *Rhynchospora divergens* in foreground with scattered clumps of *Schoenus nigricans* in background. c. glabrous-leaved coreopsis (*Coreopsis* sp. aff. *lanceolata*) on a Jackson County glade. Photos by first author.

herbs found at nearly all the glades include *Allium canadense* var. *mobile*, *Asclepias viridiflora*, *Carex cherokeeensis*, *Polygala boykinii*, *Nothoscordum bivalve*, *Ratibida pinnata*, *Rhynchospora colorata*, and *Sabatia angularis*.

A number of characteristic herbaceous species of the glades were found only in one county or the other, but

not both. *Piriqueta cistoides* ssp. *caroliniana*, *Selaginella apoda* var. *ludoviciana*, *Callirhoe papaver*, and *Symphyotrichum pratense* were present on the majority of Gadsden County glades, but were absent from those in Jackson County. *Coreopsis* sp. (aff. *lanceolata*), *Rudbeckia triloba*, and *Packera anonyma* occurred on the majority of Jackson County glades and were absent from those in Gadsden County. Dispersal or substrate may contribute to these differences. The glade clusters in the two counties are at least 40 km apart, separated by the floodplain of the Apalachicola River. In Gadsden County the glades substrate is dolomite, whereas in Jackson County it is limestone.

Floristics

The total number of taxa noted either on, or around the edge of, the twenty-one glades is 311, of which 302 are vascular plant species (Appendix). Ninety-eight species were found only on the edge of the glades. Of the vascular plants, 280 are native, 21 non-native, and one adventive from the west (*Oenothera speciosa*). The largest family represented is Asteraceae with 50 species, followed by Poaceae (39), Cyperaceae (13), and Lamiaceae (12). Fabaceae (11) is typically one of the three largest families in the floras of other calcareous glades and prairies, but is here tied with Rosaceae for fifth place.

Nine of the non-native species on Florida upland glades are considered invasive by the Florida Exotic Pest Plant Council (FLEPPC 2011; Table 1). Of these, only the three species of *Ligustrum* were frequently noted on the Florida upland glades. Two non-native species not listed as invasive by the FLEPPC, *Eremochloa ophiuroides* and *Pyracantha koidzumii*, were also frequently noted on disturbed glades and, together with the *Ligustrum* species, tend to make up the majority of the cover of non-native species on these glades.

Fifteen glades species are tracked by the Florida Natural Areas Inventory (FNAI 2012) as rare in Florida (Table 2). Fourteen of these are also listed as endangered by the state of Florida (Florida Department of Agriculture and Consumer Services 2004). Most of these are northern calciphiles near their southern range limit in

TABLE 1. Invasive non-native species on Florida glades (n=11); * = species not listed by the Florida Exotic Pest Plant Council but which are a threat to Florida glades; FLEPPC Category I - species that are invading and disrupting native plant communities in Florida; FLEPPC Category II - species that have shown a potential to disrupt native plant communities.

Species	FLEPPC-Category I	FLEPPC-Category II
<i>Eremochloa ophiuroides</i> *		
<i>Imperata cylindrica</i>	X	
<i>Ligustrum japonicum</i>	X	
<i>Ligustrum lucidum</i>	X	
<i>Ligustrum sinense</i>	X	
<i>Lonicera japonica</i>	X	
<i>Lygodium japonicum</i>	X	
<i>Melia azedarach</i>		X
<i>Nandina domestica</i>	X	
<i>Pyracantha koidzumii</i> *		
<i>Sapium sebiferum</i>	X	

TABLE 2. Rare species on Florida upland glades (n=15). FNAI rankings are at the global (G) and state (S) levels: 1- critically imperiled because of extreme rarity; 2-imperiled because of rarity; 3-very rare or local; 4-secure; 5-demonstrably secure; ?-rank provisional; state of Florida ranking: LE-listed endangered (native species in imminent danger of extinction in state due to rarity).

Species	FNAI	State
<i>Asclepias viridiflora</i>	G5 S1	LE
<i>Callirhoe papaver</i>	G5 S2	LE
<i>Carex microdonta</i>	G4 S1	LE
<i>Delphinium carolinianum</i>	G5 S1	LE
<i>Echinacea purpurea</i>	G4 S1	LE
<i>Euphorbia commutata</i>	G5 S2	LE
<i>Lepuropetalon spathulatum</i>	G4G5 S1	LE
<i>Matelea baldwyniana</i>	G3 S1	LE
<i>Matelea flavidula</i>	G4? S1	LE
<i>Matelea floridana</i>	G2 S2	LE
<i>Primula meadia</i>	G5 S1	LE
<i>Rudbeckia triloba</i>	G5 S2	LE
<i>Salvia urticifolia</i>	G5 S1	LE
<i>Stachys crenata</i>	G5 S1	LE
<i>Symphyotrichum pratense</i>	G4? S1	

Florida. Only one, *Matelea floridana*, is globally rare, the rest being rare in Florida, but relatively secure over their total range (NatureServe 2012).

Six species appear to be largely confined to the Jackson and/or Gadsden County glades and are not found elsewhere in Florida (Wunderlin and Hansen 2011 and personal observations of authors): *Asclepias viridiflora*, *Bouteloua curtipendula*, *Coreopsis* sp. (aff. *lanceolata*), *Ratibida pinnata*, *Sporobolus vaginiflorus*, and *Symphyotrichum pratense*. The moss, *Pleurochaete luteola*, was only known from the Jackson county glades, but has just recently been found on a limestone outcrop along the St Marks River in Wakulla County, Florida (first author, pers. obs.). Four others are known in Florida only from the edges and vicinity of glades: *Delphinium carolinianum*, *Echinacea purpurea*, *Primula meadia*, and *Symphyotrichum shortii*.

Coreopsis sp. (aff. *lanceolata*) is characterized by infolded, narrow, glabrous leaves which distinguish it from *C. lanceolata* (Fig. 4c). It is frequent on all nine Jackson County glades, as well as on the five possible former glades in that county. It is absent from Gadsden County glades where *Coreopsis lanceolata* is found on eight of the twelve glades. This narrow-leaved glabrous *Coreopsis* has not been observed by us in habitats other than

glades and maintains its distinctness from *C. lanceolata* when the two are grown together from seed in a common garden (first author, pers. observation).

Pleurochaete luteola has not previously been reported from Florida. In the New World it ranges on calcareous substrates from Virginia west to New Mexico and south to South America (Flora of North America Editorial Committee 2007 vol. 27). It can form the dominant ground cover in semi-shaded cedar glades in Tennessee (Quarterman 1950), is known from the Ketona Dolomite glades in Bibb County, Alabama (Allison & Stevens 2001), and was noted by the first author in 2009 at a blackland prairie at Oaky Woods Wildlife Management Area, Houston County, Georgia. In Florida we found it on two glades in Jackson County, in both cases as a single isolated patch in partial shade of *Juniperus virginiana*.

Symphytotrichum pratense is a western disjunct whose main range is centered on prairies in eastern Texas, Louisiana, and Arkansas (Jones et al. 2008). Eastward from its central range, it has widely scattered disjunct populations in open calcareous habitats in MS, AL, GA, TN, KY, and VA. The Florida population at the Gadsden glades is an isolated outpost at the southeastern extreme of its range (Jones et al. 2008, Fig. 2). Three other western species, *Callirhoe papaver*, *Hymenopappus scabiosaeus*, and *Linum medium* var. *texanum*, are frequent on Florida upland glades, but rare or absent on the Alabama blackbelt prairies, Ketona Dolomite glades, and Oaky Woods sites.

Like *Pleurochaete luteola*, *Bouteloua curtipendula* is very rare on Florida upland glades where it is at the southern limit of its range. It is common on glades and calcareous prairies to the north and west (Baskin & Baskin 2003; Campbell & Seymour 2012; Morris et al. 1993).

Of the 311 species listed, the number found at individual glades ranged from 43 to 162 (Table 3) and the average number per glade (excluding Snake which was not sampled as intensively as the others) was 105. Sorenson's Index of Similarity, i.e., the percentage of the average number of species in two glades that are held in common (Mueller-Dumbois & Ellenberg 1974), was calculated for six of the more intact glades, three in Gadsden (Brickyard, EB, and Humphrey) and three in Jackson County (Brooks-1, Bumpnose, and Old Car). Similarities ranged from 66-69% among the three Gadsden glades and 66 to 71% among the three Jackson glades. Pairwise comparisons between glades from the two different counties showed somewhat lower similarities, ranging from 53 to 63%. A value >50% is generally required for samples to be considered part of the same plant community (Barbour et al. 1980).

Comparison with floras of other calcareous openings

The percentage of Florida upland glades species found on other calcareous glades and prairies in the Southeast was determined from a literature review. Table 4 shows a comparison with sites where relatively comprehensive species lists over the entire growing season were compiled. Perhaps not surprisingly, the Florida upland glades have the highest number of species in common with those areas closest to them, namely, the blackbelt prairies in Georgia, Alabama, and Mississippi, and the Ketona Dolomite glades of Alabama, with decreasing numbers of species in common with sites farther to the north (TN, AL, GA glades) and west (isolated calcareous prairies in LA and TX). Comparison with species lists combined from a number of sites, compiled from the literature for the AL/MS blackbelt prairies and for the Southeastern cedar glades, shows the same pattern.

Occurrence of some common Florida upland glades species at nearby calcareous sites (listed in Table 4) are shown in Table 5. Species common on Florida glades that also occur on most other calcareous openings in the Southeast include two of the most characteristic Florida upland glades species, found in few other habitats in the state, *Asclepias viridiflora* and *Sporobolus vaginiflorus*. Common Florida upland glades species found only on the closest sites (Ketona Dolomite glades, AL/MS blackbelt, and Oaky Woods) are generally southern coastal plain species. An example is *Evolvulus sericeus*, which reaches its northern range limit in Georgia (Bridges & Orzell 1989). This is also largely true of common Florida upland glades species that are absent from other calcareous openings to the north and west. Among these is a dominant species on Florida upland glades, *Schoenus nigricans*, which is spottily distributed from northern Europe to South Africa and North America. In the U.S it is found in Florida, Texas, California, and Nevada. Over its entire range it spans a wide diversity of habitats from acid bogs in northern Europe to hot springs in California (Munz & Keck 1959; Sparling 1968). In

TABLE 3. Characteristics of the 21 Florida glades studied. Dominant species: **Sn**=*Schoenus nigricans*, **Sv**=*Sporobolus vaginiflorus*, **Rd**=*Rhynchospora divergens*, **Mc**=*Muhlenbergia capillaris*. *Snake glade was visited 4 times prior to 2005.

No. on map	Glade	County	Size (ha)	No. of species	No. of visits (2005–2012)	Dominant species	Current condition	Ownership
1	East Bank Campground	Decatur, GA	0.02	58	4	Rd/Sv	good	private
2	PRIDE	Gadsden	0.05	82	4	Rd/Sv	partly disturbed	state
3	Railroad	Gadsden	0.20	98	4	Sn	good	state
4	River Junction	Gadsden	0.20	120	8	Sn/Rd	partly disturbed	private
5	Brickyard	Gadsden	0.59	135	14	Sn/Rd/Sv	good	private
6	Powerline	Gadsden	0.05	113	15	Rd	partly disturbed	private
7	EB	Gadsden	0.39	142	12	Sn/Rd/Sv	good	private
8	Selway line	Gadsden	0.03	78	6	Sn	good	private
9	Chalky	Gadsden	0.43	135	6	Sn	good	private
10	Aster shortii	Gadsden	0.09	88	4	Rd	partly disturbed	private
11	Snake*	Gadsden	0.09	43	0	Rd	destroyed	private
12	Humphrey	Gadsden	0.60	124	5	Sn/Rd/Sv	good	private
13	Old car	Jackson	0.13	112	9	Rd/Sv/Mc	good	private
14	Williams-2	Jackson	0.21	121	10	Sn	partly disturbed	private
15	Moranz	Jackson	0.10	105	10	Sn	good	state
16	Bennett	Jackson	0.06	71	7	Sn/Rd/Sv	partly disturbed	private
17	Bumpnose	Jackson	0.39	123	13	Sn/Rd/Sv	partly disturbed	private
18	Brooks-1	Jackson	0.76	162	15	Sn/Rd/Sv/Mc	good	private
19	Brooks-4	Jackson	0.11	67	3	Sn	destroyed	private
20	Brooks-2	Jackson	0.59	95	2	Sn	destroyed	private
21	West of SR 73	Jackson	0.11	71	7	Mc	partly disturbed	private

Florida it occurs on moist to wet calcareous substrates in the panhandle, throughout south Florida, and in two counties on the central west coast of the peninsula (Wunderlin & Hansen 2008). Of the twenty-seven species frequently found on nearby calcareous openings but not found on Florida glades, six occur in Florida in other habitats and the rest do not range south to Florida. Five of these have their centers of distribution in the West or Midwest and are disjunct to the east on calcareous glades and prairies (Bridges & Orzell 1986; Brown 2003).

CONCLUDING REMARKS

In terms of dominant species, Florida upland glades differ from other calcareous glades and prairies to the north and west in the dominance of species in the Cyperaceae (*Schoenus nigricans*, *Rhynchospora divergens*) and the relative paucity of species in the Fabaceae.

Questions outside the scope of this paper that remain for future studies to answer include the relative roles soil texture, soil depth, and fire frequency have in controlling woody colonization of the Florida upland glades, plus the relative roles of disturbance and soil depth in determining the distribution of herbaceous dominants within any single glade.

In the context of the rest of the Southeast, the Florida upland glades can be considered a somewhat anomalous southeastern outpost of a series of calcareous glades and prairies extending eastward from Texas through Louisiana, Mississippi, Alabama, and Georgia. From an examination of aerial photographs of potential glade openings in the two Florida counties, it appears likely that glade openings were more numerous in pre-settlement times, but probably did not extend much further geographically than at present. The Florida upland glades community (denoted as “upland glade”) is ranked G1S1 (critically imperiled) by the Florida Natural Areas Inventory (FNAI 2010) and is the only highly ranked community in Florida without a prominent site under protection. Currently one small Florida glade is protected on a state park (Moranz) and two (Railroad and Pride) are on public land that is not actively managed for their protection. Of those on private land, two have been destroyed by mining (Brooks-4 and Brooks-2) and five (Bumpnose, Brooks-1, Brickyard, Aster

TABLE 4. Comparison of the species list for Florida upland glades with species lists for other calcareous openings in the Southeast.

Site	Number of native species in common with Florida (percent of Florida's total)	Total no. of native species	Distance from Florida glades (km)
Lists from single studies:			
FL: Jackson and Gadsden County glades (this study)	281 (100%)	281	N/A
GA: Oaky Woods Wildlife Management Area, GA (Echols & Zomlefer 2010)	137 (48.7%)	319	225
AL: Ketona Dolomite outcrops, AL (Allison & Stevens 2001)	132 (46.9%)	320	340
AL: blackbelt prairies (Schotz 2011)	122 (43.4%)	245	~260
MS: blackbelt prairie (Pulliam Prairie)(Campbell & Seymour 2012)	120 (42.7%)	415	513
LA: Kisatchie National Forest, Keiffer and Packton prairies (MacRoberts & MacRoberts 1995, 1996)	94 (33.4%)	193	745
TX: Windham Prairie, TX (Brown et al. 2002)	90 (32%)	217	964
Composite lists from several studies:			
MS/AL blackbelt prairies -from literature (Campbell & Seymour 2012)	141 (50.2%)	508	500-230
Southeastern cedar glades (TN KY,AL,GA,VA)-from literature (Baskin & Baskin 2003)	119 (42.3%)	450	~450

TABLE 5. Occurrence of Florida glades species on other calcareous openings in the Southeast (cited in Table 4).

SPECIES COMMON THROUGHOUT (Species present on most Florida glades as well as on most other calcareous openings in Southeast.)	ON FLORIDA GLADES AND NEARBY AREAS ONLY (Species present on most Florida glades that are shared only with the closest calcareous openings: O=Oaky woods; K=Ketona Dolomite glades; A= AL, MS blackbelt prairies; L= LA Kisatchie prairies.	ON FLORIDA GLADES ONLY (Species present on most Florida glades and not listed from other calcareous openings in Southeast.)	COMMON THROUGHOUT BUT NOT ON FLORIDA GLADES (Species frequently listed on the closest calcareous openings but absent from Florida glades; nomenclature for species not in Florida (*) follows Weakley 2012; ¹=western disjunct.
<i>Aristida longispica</i>	<i>Allium canadense</i> var. <i>mobile</i> -K,A	<i>Carex gholsonii</i>	<i>Anenome berlandieri</i>
<i>Asclepias verticillata</i>	<i>Asemeia</i> (<i>Polygala</i>) <i>grandiflora</i> -K,A	<i>Coreopsis</i> sp. (aff. <i>lanceolata</i>)	<i>Blephillia ciliata</i> *
<i>Asclepias viridiflora</i>	<i>Evolvulus sericeus</i> -A	<i>Cornus foemina</i>	<i>Carex granularis</i> *
<i>Berchemia scandens</i>	<i>Fleischmannia incarnata</i> -O,K	<i>Eremochloa ophiuroides</i>	<i>Chamaesyce nutans</i>
<i>Brickellia eupatorioides</i>	<i>Liatris elegantula</i> -O,A	<i>Piriqueta cistoides</i> ssp. <i>caroliniana</i>	<i>Cornus drummondii</i> *
<i>Carex cherokeensis</i>	<i>Myrica cerifera</i> -O,K,L	<i>Schoenus nigricans</i>	<i>Dalea candida</i> *¹
<i>Cercis canadensis</i>	<i>Rhynchospora colorata</i> -K,A	<i>Selaginella apoda</i> var. <i>ludoviciana</i>	<i>Dalea purpurea</i> *¹
<i>Diospyros virginiana</i>	<i>Rhynchospora divergens</i> -K,A	<i>Sideroxylon reclinata</i>	<i>Desmanthus illinoensis</i>
<i>Erigeron strigosus</i>	<i>Rhynchospora globularis</i> -K		<i>Echinacea pallida</i> *¹
<i>Fraxinus americana</i>	<i>Ruellia carolinensis</i> -O,A		<i>Eurybia hemispherica</i>
<i>Juniperus virginiana</i>	<i>Sabal minor</i> -K		<i>Heliotropium tenellum</i> *¹
<i>Manfreda virginica</i>	<i>Sporobolus junceus</i> -K,A,L		<i>Houstonia purpurea</i> var. <i>calycosa</i> *
<i>Nothoscordum bivalve</i>	<i>Thaspium barbinode</i> -K		<i>Hypericum sphaerocarpum</i> *¹
<i>Panicum flexile</i>			<i>Lithospermum canescens</i> *
<i>Plantago virginica</i>			<i>Lobelia spicata</i> *
<i>Sabatia angularis</i>			<i>Nemastylis geminiflora</i> *
<i>Salvia lyrata</i>			<i>Neptunia lutea</i> *¹
<i>Schizachyrium scoparium</i>			<i>Polytaenia nuttallii</i> *
<i>Setaria parviflora</i>			<i>Rhus aromatica</i>
<i>Sporobolus clandestinus</i>			<i>Ruellia humilis</i> *
<i>Sporobolus vaginiflorus</i>			<i>Silphium laciniatum</i> *
<i>Stenaria nigricans</i>			<i>Sisyrinchium albidum</i>
<i>Tridens flavus</i>			<i>Solidago</i> (<i>Oligoneuron</i>) <i>rigida</i> *
<i>Ulmus alata</i>			<i>Sorghastrum nutans</i>
<i>Viburnum rufidulum</i>			<i>Spiranthes magnicamporum</i> *
			<i>Symphyotrichum novae-angliae</i> *
			<i>Trichostema bractiata</i> *

shortii, and Williams-2) have been heavily to partially disturbed by roads, food plots, or parking of heavy machinery, since the onset of this study in 2005. Clearly the seven largest, mostly intact glades (EB, Humphrey, Chalky, and Brickyard in Gadsden County; Bumpnose, Brooks-1, and Old Car in Jackson County) will remain in jeopardy until protected, either by acquisition as public lands or by conservation easement.

APPENDIX

Annotated list of vascular plant taxa on 21 upland glades in Jackson and Gadsden counties, Florida (n=302), plus a cyanobacterium and some common moss and ground lichen taxa (n=9). Nomenclature for vascular plants follows Wunderlin and Hansen (2011), for mosses Crum and Anderson (1981), and for lichens Brodo et al. (2001), except where otherwise noted. Underlined taxa are common on, and/or characteristic of, these glades; FNA=Flora of North America Editorial Committee; ¹=listed as endangered or threatened by the state of Florida, ²=tracked as rare by the Florida Natural Areas Inventory, *= non-native; J-1, G-2= number of glades where found in Jackson County (n=9) and Gadsden County (n=12); O=open glade, E=edge of glade, i.e. near or under the zone of shrubs commonly bordering the glades, V=vicinity of glade; abundance (within individual glades, not across all glades): rare, infrequent, occasional, local, frequent, common; specimen collector and collection number (AFJ, LCA, WWB, and AKG are the authors, JBN is John B. Nelson, and MAG is Mark A. Garland). Except where otherwise noted, AKG specimens are deposited in University of Florida herbarium (FLAS) and all others are deposited in R.K. Godfrey herbarium at Florida State University (FSU); + indicates additional specimens from Florida glades are present in the respective herbarium collections.

CYANOBACTERIA

Nostocaceae

Nostoc sp., witches' jelly; J-7, G-8; O (common)

LICHENS

Cladoniaceae

Cladina evansii (Abbayes) Hale & W.L. Culb., powder-puff lichen; J-2, G-1; O,E (rare)

Cladina subtenuis (Abbayes) Hale & W.L. Culb., Dixie reindeer lichen; J-5, G-10; O,E (infrequent)

MOSSES

Brachytheciaceae

Bryoandersonia illecebra (Hedw.) H. Robin., wormy moss; J-1, G-2; E (local patches); AFJ 10344 (FLAS)+

Fissidentaceae

Fissidens cristatus Wilson ex Mitt., pocket moss; G-1; E (rare)

Funariaceae

Funaria hygrometrica Hedw., bonfire moss; J-5, G-1; O (local patches in disturbed areas); AFJ s.n. (5 February 2009, Brickyard; FLAS)

Pottiaceae

Pleurochaete luteola (Bescherelle) Theriot (FNA 2007 vol. 27), glades moss; J-2, O,E (rare); AFJ 10245 (FLAS)+

Weissia jamaicense (Mitt.) Grout, twisted moss; J-7, G-8; O (common); AFJ 10364 (FLAS)+

Thuidiaceae

Thuidium delicatulum (Hedw.) BSG, delicate fern moss; J-2; E (infrequent); AFJ s.n. (17 October 2007, Old Car; FLAS)

FERNS and FERN ALLIES

Dennstaedtiaceae

Pteridium aquilinum (L.) Kuhn, bracken fern; J-1, G-2; E (infrequent)

Ophioglossaceae

Ophioglossum petiolatum Hook., stalked adders-tongue; J-1; O (rare)

Polypodiaceae

Pleopeltis polypodioides (L.) E.G. Andrews & Windham var. *michauxiana* (Weath.) E.G. Andrews & Windham, resurrection fern (on *Juniperus virginiana*); J-6, G-4; O (occasional), E (common)

Selaginellaceae

Selaginella apoda (L.) Fernald var. *ludoviciana* (A. Braun) B.F. Hansen & Wunderlin, Gulf spike-moss; G-11; O,E (local patches); LCA 9199

Schizaeaceae

*Lygodium japonicum** (Thun.) Sw., Japanese climbing fern; J-7, G-9; O,E (infrequent)

Thelypteridaceae

Thelypteris kunthii (Desv.) C.V. Morton, widespread maidenfern; G-4; E (infrequent to locally common); AFJ 10523+

GYMNOSPERMS

Cupressaceae

Juniperus virginiana L., eastern red cedar, J-9, G-12; O,E (occasional to common)

Pinaceae

Pinus echinata Mill., shortleaf pine; G-3; E (infrequent)

Pinus glabra Walter, spruce pine; G-2; E (infrequent)

Pinus palustris Mill., longleaf pine; G-2; E,V (rare)

Pinus taeda L., loblolly pine; J-9, G-9; O (occasional –mostly as seedlings), E (frequent)

ANGIOSPERMS

Acanthaceae

Dyschoriste oblongifolia (Michx.) Kuntze, oblongleaf twinflower; G-2; O (rare)

Elytraria carolinensis (J.F. Gmel.) Pers., Carolina scalystem, G-8; O,E (occasional); JBN 2739.

Ruellia caroliniensis (J.F. Gmel.) Steud., Carolina wild petunia, J-9, G-11; O (occasional); LCA 21493

Adoxaceae

- Viburnum dentatum* L., arrow-wood; J-1, G-3; E (infrequent)
Viburnum obovatum Walter, Walter's viburnum; J-2, G-8; E (occasional); LCA 21858
Viburnum rufidulum Raf., rusty black-haw; J-5, G-5; E (frequent)

Agavaceae

- Manfreda virginica* (L.) Salisb. ex Rose, false aloe; J-7, G-8; O (infrequent); LCA 21232+
Yucca aloifolia L., Spanish bayonet; J-1; E (local); LCA 21910
Yucca filamentosa L., Adam's needle; J-3, G-9; O (occasional)

Alliaceae

- Allium canadense* L. var. *mobilense* (Regel) Owenbey, meadow garlic; J-7, G-11; O (frequent); LCA 10485 +
Nothoscordum bivalve (L.) Britton, false garlic; J-7, G-12; O (frequent)

Altingiaceae

- Liquidambar styraciflua* L., sweetgum; J-2, G-3; E (occasional)

Anacardiaceae

- Rhus copallinum* L., winged sumac; J-7, G-5; O,E (infrequent)
Toxicodendron radicans (L.) Kuntze, poison ivy; J-5, G-5; O,E (infrequent)

Apiaceae

- Chaerophyllum tainturieri* Hook., hairyfruit chervil; G-3; O (occasional-disturbed areas)
Eryngium yuccifolium Michx., button eryngo; J-2, G-1; O,E (infrequent)
Thaspium barbinode (Michx.) Nutt., hairyjoint meadowparsnip; J-6; E,V (frequent); LCA 21905+
Thaspium trifoliatum (L.) A. Gray, purple meadowparsnip; G-7; E (locally common); LCA 21845, AKG 10396
Zizia aurea (L.) Koch, golden alexanders; G-7; O,E (occasional), V (locally common); LCA 21841+, AKG 10919+

Apocynaceae

- Apocynum cannabinum* L., dogbane; J-1, G-1; E (rare)
Asclepias tuberosa L., butterflyweed; J-3; E (rare)
Asclepias verticillata L., whorled milkweed; G-8; O (infrequent); JBN 2743
Asclepias viridiflora^{1,2} Raf., green milkweed; J-9, G-9; O (occasional); LCA 20772+, AKG 11436+
Asclepias viridis Walter, green antelopehorn; G-2; E,V (rare); RKG 81249, AKG 9777
Gonocarpus suberosa (L.) R.Br., angle pod; J-3, G-6; O,E (rare), V (occasional); LCA 21839
Matelea baldwyniana^{1,2} (Sweet) Woodson, Baldwin's spinypod; G-2; E,V (infrequent)
Matelea flavidula^{1,2} (Chapm.) Woodson, Carolina milkvine; G-1; E,V (rare)
Matelea floridana^{1,2} (Vail) Woodson, Florida milkvine; J-1; E (rare); LCA 21921+

Aquifoliaceae

- Ilex vomitoria* Aiton, yaupon; J-8, G-9; O (rare), E (common)

Areaceae

- Sabal minor* (Jacq.) Pers., blue palmetto; J-1, G-10; O,E (infrequent)
Serenoa repens (W. Bartram) Small, saw palmetto; G-3; E (rare)

Aristolochiaceae

- Aristolochia serpentaria* L., Dutchman's pipe; J-2, G-1; E,V (rare)

Asteraceae

- Ambrosia artemisiifolia* L., common ragweed; J-5, G-2; O (rare)
Ambrosia psilostachya DC., western ragweed; J-1; E (rare); LCA 21377
Baccharis halimifolia L., saltbush; J-2, G-4; O (rare-disturbed areas)

- Bidens alba* (L.) DC., beggarticks; J-1, G-2; O (rare-disturbed areas)
Brickellia eupatorioides (L.) Shinnars, false boneset; J-4, G-4; O,E (infrequent); LCA 21504+, AKG 11521
Chaptalia tomentosa Vent., sunbonnets; G-3; O (rare)
Chrysopsis mariana (L.) Elliott, Maryland goldenaster; J-3; E (rare)
Cirsium altissimum (L.) Spreng., tall thistle; J-1; E (rare)
Cirsium horridulum Michx., horrible thistle; J-7, G-6; O (occasional)
Conoclinium coelestinum (L.) DC., blue mistflower; J-8, G-9; O (rare), E (frequent)
Conyza canadensis (L.) Cronquist, Canadian horseweed; J-1, G-1; O,E (rare-disturbed areas)
Coreopsis lanceolata L., lanceleaf tickseed; G-8; O (frequent); AFJ 10377a+
Coreopsis sp. (aff. *lanceolata*), Jackson glades tickseed; J-9; O (frequent); AFJ 10353a+
Echinacea purpurea^{1,2} (L.) Moench, eastern purple coneflower; G-6; O (rare), E (common); LCA 21837, AKG 9811+
Erigeron strigosus Muhl. ex Willd., prairie fleabane; J-9, G-11; O (frequent); AFJ 10508, AKG 11272
Eupatorium capillifolium (Lam.) Small ex Porter & Britton, dogfennel; J-1, G-2; O,E (rare-disturbed areas)
Fleischmannia incarnata (Walter) R.M. King & H. Rob., pink thoroughwort; J-5, G-10; E (frequent); RKG 80088
Gaillardia aestivalis (Walter) H. Rock, lanceleaf blanketflower; J-5; O (occasional); LCA 21207+
Helenium amarum (Raf.) H. Rock, bitterweed; J-2; O (rare)
Helenium autumnale L., common sneezeweed; J-2, G-6; E (frequent)
Helianthus radula (Pursh.) Torr. & A. Gray, black sunflower; G-1; O (frequent); JBN 2754
Helianthus resinosus Small, resin-dot sunflower; J-1; E (infrequent); JBN 2802
Heliopsis gracilis Nutt. (FNA 2006 vol. 21), smooth oxeye; J-2, G-8; O,E (occasional); LCA 10483+, AKG 11016
Hymenopappus scabiosaes L'Her., Carolina woollywhite; J-6; O (frequent); LCA 21962+
Liatris elegantula (Greene) K. Schum., grassleaf gayfeather; J-7, G-9; O (frequent); AFJ 10264+, AKG 11490 [=L. *graminifolia* Willd.]
Liatris squarrosa (L.) Michx., scaly gayfeather; G-2; O (occasional); AKG 12007
Liatris squarrosa Michx., Appalachian gayfeather; J-1; E,V (rare); AFJ 10489
Melanthera nivea (L.) Small, snow squarestem; J-3, G-7; E (infrequent)
Packera anonyma (A.W. Wood) W.A. Weber & A. Love, golden ragwort; J-8; O,E (occasional); LCA 21205+
Pyrrhopappus carolinianus (Walter) DC., desert chicory; J-1; O (rare)
Ratibida pinnata (Vent.) Barnhart, prairie coneflower; J-6, G-6; O,E (common); LCA 21855+
Rudbeckia fulgida Aiton, orange coneflower; G-6; O,E (common); AFJ 10303+, AKG 10084
Rudbeckia triloba^{1,2} L., browneyed susan; J-9; O,E (common); LCA 21175+
Silphium asteriscus L., starry rosinweed; J-8, G-8; E (occasional); AKG 10085
Solidago altissima L. (FNA 2006 vol. 20), tall goldenrod; J-3, G-2; O,E (rare); LCA 21442
Solidago auriculata Shuttlew. ex S.F. Blake, eared goldenrod; J-6; O,E (occasional); LCA 21464+
Solidago caesia L., bluestem goldenrod; J-1, G-2; E (frequent); LCA 21496+
Solidago nemoralis Aiton, Dyersweed goldenrod; G-3; O (common); AFJ 10459
Symphotrichum concolor (L.) G.L. Nesom, Eastern silver aster; J-1, G-4; O,E (infrequent); WWB s.n. (1 November 2007, Brooks-1)

Symphytotrichum dumosum (L.) G.L. Nesom, rice-button aster; J-9, G-11; O (frequent); AFJ s.n. (1 November 2010, Brooks-1)+, AKG 10676

Symphytotrichum laeve (L.) A. Love & D. Love var. *concinnum* (Willd.) G.L. Nesom, smooth blue aster; J-4, G-1; E (occasional); LCA 21385+

Symphytotrichum lanceolatum (Willd.) G.L. Nesom var. *latifolium* (Semple and Chmiel.) G.L. Nesom, white panicle aster; J-1; E (rare); LCA 21455

Symphytotrichum lateriflorum (L.) A. Love & D. Love, calico aster; J-3, G-4; O,E (infrequent); LCA 21498+

Symphytotrichum oolentangiense (Riddell) G.L. Nesom, swordleaf wood aster; J-1, G-3; O,E (occasional); LCA 21492+

Symphytotrichum patens (Aiton) G.L. Nesom, late purple aster; J-1; O (rare); AFJ 10441

Symphytotrichum pilosum (Willd.) G.L. Nesom, white oldfield aster; J-2; E (rare); LCA 21456

*Symphytotrichum pratense*² (Raf.) G.L. Nesom (FNA 2006 vol. 20), western silver aster; G-7; O (occasional); AFJ s.n. (17 October 2007, EB West)+, AKG 11507

Symphytotrichum shortii (Lindl.) G.L. Nesom, Short's aster; J-2, G-5; E (rare); LCA 21440 FSU+

Symphytotrichum undulatum (L.) G.L. Nesom, wavyleaf aster; J-3, G-4; O,E (occasional); LCA 21511+

Verbesina virginica L., white crownbeard; J-4, G-8; O (rare), E (occasional)

Berberidaceae

*Nandina domestica** Thunb., heavenly bamboo; J-3, G-2; O,E (rare)

Betulaceae

Ostrya virginiana (Mill.) K. Koch, eastern hophornbeam; J-4, G-1; E (infrequent)

Bignoniaceae

Bignonia capreolata L., crossvine; G-2; O,E (rare)

Campsis radicans (L.) Seemann, trumpet creeper; J-5, G-1; O (rare), E (infrequent)

Boraginaceae

Lithospermum incisum Lehm., narrowleaf gromwell; J-2, G-1; O,E,V (rare); AFJ s.n. (12 May 2010, Brooks-1)+

Lithospermum tuberosum Rugel ex DC., tuberous gromwell; J-2, G-8; E (infrequent); LCA 9200

Onosmodium virginianum (L.) DC., false gromwell; G-3; O (infrequent); JBN 2728

Campanulaceae

Campanula americana L., American bellflower; J-4; O,E (rare); LCA 21368

Lobelia amoena Michx. var. *glandulifera* A. Gray, southern lobelia; G-2; E (rare); LCA 21483+

Lobelia puberula Michx., downy lobelia; J-1, G-3; O,E,V (occasional); LCA 21443+

Triodanis biflora (Ruiz & Pav.) Greene, small Venus' looking-glass; G-1; O,E (rare)

Triodanis perfoliata (L.) Nieuwl., Venus' looking-glass; J-2, G-2; O (infrequent)

Caprifoliaceae

*Lonicera japonica** Thunb., Japanese honeysuckle; J-5; O,E (infrequent)

Lonicera sempervirens L., coral honeysuckle; J-3, G-7; E (occasional)

Valerianella radiata (L.) Dufr., beaked cornsalad; J-1, G-1; O (rare-disturbed areas)

Celtidaceae

Celtis laevigata Willd., sugarberry; J-6, G-6; O (rare), E (occasional); RKG 80516

Celtis tenuifolia Nutt. (FNA 1997 vol. 3), dwarf hackberry; J-3; G-5; O,E (infrequent); AFJ 10241

Clusiaceae

Hypericum hypericoides (L.) Crantz, St. Andrew's-cross; J-4, G-7; O,E (infrequent); AFJ 10335

Commelinaceae

Commelina erecta L., whitemouth dayflower; G-2; E (rare); AFJ 10263

Convolvulaceae

Cuscuta pentagona Engelm., fiveangled dodder; J-1; O (rare); LCA 21380 (on *Liatris*)

Dichondra carolinensis Michx., ponysfoot; J-4, G-4; O,E (rare)

Evolvulus sericeus Sw., silver dwarf morning-glory; J-8, G-6; O (frequent); LCA 21911+, AKG 9706

Ipomoea cordatotriloba Dennst., tievine; J-1, G-1; O,E (rare)

Ipomoea pandurata (L.) G. Mey, man-of-the-earth; J-4, G-2; O,E (infrequent)

Cornaceae

Cornus asperifolia Michx., roughleaf dogwood; J-6, G-8; E (infrequent); LCA 21836+

Cornus florida L., flowering dogwood; J-6, G-4; E (occasional)

Cornus foemina Mill., swamp dogwood; J-5, G-7; E (occasional); LCA 20754+

Cyperaceae

Carex cherokeensis Schwein., Cherokee sedge; J-7, G-9; O,E (occasional); LCA 21601+, AKG 11273+

Carex gholsonii Naczi & Cochrane, Gholson's sedge; J-3, G-6; O (infrequent); LCA 20684+, AKG 11789

Carex microdonta^{1,2} Torr. & Hook., littletooth sedge; G-3; O (common); LCA 11194+, AKG 11969

Carex striatula Michx., line sedge; J-2; E (occasional); LCA 21593

Carex styloflexa Buckley, bent sedge; G-2; E (rare); LCA 11222+

Fimbristylis puberula (Michx.) Vahl, hairy fimbry; J-6, G-7; O (frequent); AFJ s.n. (17 October 2007, Brickyard)+, AKG 9749

Rhynchospora colorata (L.) H. Pfeiff., whitetop sedge; J-2, G-10; O (frequent); JBN 2742

Rhynchospora divergens Chapman ex M.A. Curtis, spreading beaksedge; J-5, G-10; O (common); LCA 11206+, AKG 5136

Rhynchospora globularis (Chapm.) Small, globe beaksedge; J-4; G-8; O (frequent); AFJ s.n. (12 May 2010, Bumpnose)+

Schoenus nigricans L., black bogrush; J-7, G-9; O (common); LCA 21597+

Scleria oligantha Michx., littlehead nutrush; G-6; O (occasional); LCA 29914+

Scleria triglomerata Michx., tall nutgrass; J-2; O (rare)

Scleria verticillata Muhl. ex Willd., low nutrush; J-2, G-2; O (occasional); LCA 20750+

Dioscoreaceae

Dioscorea villosa L., wild yam; G-3; E (infrequent)

Ebenaceae

Diospyros virginiana L., persimmon; J-9, G-6; O,E (frequent)

Euphorbiaceae

Chamaesyce hyssopifolia (L.) Small, hyssopleaf sandmat; J-5, G-9; O (frequent); LCA 21856+, AKG 11078

Euphorbia commutata^{1,2} Engelm. ex A. Gray, wood spurge; G-4; O,E (rare)

Euphorbia discoidalis Chapm., summer spurge; J-4, G-2; O (frequent); LCA 21441+

*Sapium sebiferum** (L.) Roxb., Chinese tallowtree; J-1, G-1; O,E (rare-disturbed areas)

Tragia cordata Michx., heartleaf noseburn; G-4; O,E (infrequent); LCA 21505

Tragia urticifolia Michx., nettleleaf noseburn; J-2, G-7; O,E (occasional); JBN 2738, AKG 9808

Fabaceae

Centrosema virginianum (L.) Benth., butterfly pea; J-6, G-4; O (rare), E (occasional)

Cercis canadensis L., redbud; J-8, G-12; O,E (common)

Crotalaria rotundifolia J.F. Gmel., rabbitbells; J-5; O,E (rare); AFJ 10300

Desmodium rotundifolium DC., prostrate ticktrefoil; J-2; O (rare); LCA 21388

Erythrina herbacea L., coral bean; J-2, G-1, E (rare)

*Lespedeza cuneata** (Dum Cours.) G. Don, Chinese lespedeza; J-1; O (rare)

Rhynchosia difformis (Elliott) DC., snoutbean; J-3; O,E (rare); LCA 21117

Rhynchosia reniformis DC., dollarleaf; J-2; O (infrequent)

Senna marilandica (L.) Link., Maryland wild sensitive plant; J-1; E (rare)

Strophostyles umbellata (Muhl. ex Willd.) Britton, pink fuzzybean; J-1; E (rare)

*Trifolium campestre** Shreb., field clover; J-2, G-1; O (rare)

Fagaceae

Quercus muhlenbergii Engelm., chinquapin oak; J-9, G-3; E (common); LCA 21452+

Quercus nigra L., water oak; J-1; E (infrequent)

Quercus shumardii Buckley, Shumard's oak; J-1; E (infrequent)

Quercus stellata Wangenh., post oak; J-1; E (infrequent)

Quercus virginiana Mill., live oak; J-8; G-3; E (frequent)

Gelsemiaceae

Gelsemium sempervirens (L.) W.T. Aiton, yellow jessamine; J-3, G-3; E (occasional)

Gentianaceae

Sabatia angularis (L.) Pursh., rosepink; J-9, G-7; O (frequent); LCA 21204+, AKG 10594

Hydrangeaceae

Hydrangea quercifolia W. Bartram, oakleaf hydrangea; G-1; E,V (rare)

Hypoxidaceae

Hypoxis wrightii (Baker) Brackett, bristleseed yellow stargrass; J-2, G-1; O (infrequent); AFJ 10394

Iridaceae

Sisyrinchium nashii E.P. Bicknell, Nash's blue-eyed grass; J-3, G-2; O,E (infrequent); LCA 21589+

*Sisyrinchium rosulatum** E.P. Bicknell, annual blue-eyed grass; J-4; O (infrequent-disturbed areas)

Juglandaceae

Juglans nigra L., black walnut; J-2; E (rare)

Lamiaceae

Callicarpa americana L., beautyberry; J-9, G-10; O (rare), E (common)

Hyptis alata (Raf.) Shinnars, clustered bushmint; J-1, G-9; O,E (infrequent)

Pycnanthemum albescens Torr. & A. Gray ex A. Gray, whiteleaf mountainmint; J-1, G-1; O (rare); LCA 21200

Pycnanthemum setosum Nutt., awned mountainmint; J-1; O (rare); LCA 21912

Pycnanthemum tenuifolium Schrad., narrowleaf mountainmint; J-3; O,E (rare); LCA 21900+

Salvia azurea Michx. ex Lam., blue sage; J-4, G-9; O,E (frequent); MAG 1073+

Salvia lyrata L., lyreleaf sage; J-9, G-10; O (occasional)

Salvia urticifolia^{1,2} L., nettleleaf sage; J-5, G-2; E,V (occasional); LCA 21366, AKG 11489+

Scutellaria integrifolia L., helmet skullcap; G-3; O (rare)

Scutellaria parvula Michx., small skullcap; G-3; O (rare); RKG 81983

Stachys crenata^{1,2} Raf., shade betony; G-1; O (rare); LCA 11208+, AKG 9747

Trichostema dichotomum L., forked bluecurls; J-5, G-1; O (infrequent); AFJ 10443a

Lentibulariaceae

Pinguicula pumila Michx., small butterwort; G-1; O (local)

Linaceae

Linum medium (Planch.) Britton var. *texanum* (Planch.) Fernald, stiff yellow flax; J-6, G-6; O (occasional); LCA 21192+

Loganiaceae

Mitrella petiolata (G.F. Gmel.) Torr. & A. Gray, lax hornpod; G-2; O,E (rare)

Mitrella sessilifolia (J.F. Gmel.) G. Don, swamp hornpod; G-1; O (infrequent)

Magnoliaceae

Liriodendron tulipifera L., tuliptree; G-7; E (infrequent)

Magnolia grandiflora L., southern magnolia; J-3; G-9; E (infrequent)

Malvaceae

Callirhoe papaver^{1,2} (Cav.) A. Gray, poppy mallow; G-7; E (frequent); LCA 21838+, AKG 9750

Modiola caroliniana (L.) G. Don, Carolina bristlemallow; G-2; O,E (rare - disturbed areas)

Sida elliotii Torr. & A. Gray, Elliott's fanpetals; J-3; E,V (rare); LCA 21373+

Meliaceae

*Melia azedarach** L., chinaberry tree; J-2; O,E (rare)

Myricaceae

Myrica cerifera L., wax myrtle; J-6, G-11; O,E (frequent)

Oleaceae

Chionanthus virginicus L., white fringetree; G-6; O (occasional), E (rare)

Fraxinus americana L., American ash; J-9, G-12; O (rare), E (common)

*Ligustrum japonicum** Thunb., Japanese privet; J-1, G-2; E (rare); LCA 21595+

*Ligustrum lucidum** W.T. Aiton, glossy privet; J-3; G-3; E (infrequent); AFJ 10456+

*Ligustrum sinense** Lour., Chinese privet; J-7, G-3; O,E, (occasional); LCA 11204+

Onagraceae

Gaura filipes Spach, slenderstalk beeblossom; J-6, G-9; O (frequent); AFJ 10279+

*Oenothera speciosa** Nutt., pinkladies; J-3; O (rare); LCA 21903

Orchidaceae

Hexalectris spicata (Walter) Barnhart, crested coralroot; J-1; E,V (rare)

Ponthieva racemosa (Walter) C. Mohr, hairy shadow witch; J-5, G-3; O,E (rare); AKG 6785

Spiranthes odorata (Nutt.) Lindl., fragrant ladiestresses; G-1; E (rare); LCA 21485

Spiranthes ovalis Lindl., October ladiestresses; G-2; E (rare); AFJ 10449

Spiranthes tuberosa Raf., little ladiestresses; J-1; O (rare)

Orobanchaceae

Agalinis obtusifolia Raf., tenlobe false foxglove; J-1, G-3; O (frequent); LCA 20772+, AKG 11077+

Agalinis tenuifolia (Vahl.) Raf., slenderleaf false foxglove; J-6, G-9; O (frequent); LCA 21510+

Aureolaria flava (L.) Farw., smooth yellow false foxglove; G-1; E (frequent)

Buchnera americana L., American bluehearts; J-4, G-2; O (infrequent)

Pedicularis canadensis L., Canadian lousewort; G-3; E,V (occasional)

Oxalidaceae

Oxalis corniculata L., common yellow woodsorrel; J-1, G-4; O (occasional)

Parnassiaceae

Lepuropetalon spathulatum^{1,2} Elliott, little people; G-1; O,E (rare); LCA 11090+, AKG 11275

Passifloraceae

Passiflora lutea L., yellow passionflower; J-2, G-3; E (rare)

Plantaginaceae

Mecardonia acuminata (Walter) Small, axilflower; J-7, G-9; O (frequent); AFJ 10286+

Penstemon australis Small, beardtongue; J-1, G-4; O (rare); AKG 7774 (FSU)

Penstemon laevigatus Aiton, eastern smooth beardtongue; G-3, O,E (rare); LCA 21840

Plantago virginica L., Virginia plantain; J-7, G-3; O (frequent); AFJ s.n. (10 May 2005, Brooks-1), AKG 11274

Poaceae

Andropogon gerardii Vitman, big bluestem; G-1; O (rare); AFJ s.n. (17 October 2007, EB East)

Andropogon glomeratus (Walter) Britton et al., bushy bluestem; J-8, G-10; O (occasional); AFJ s.n. (15 November 2007, East Bank Campground)

Andropogon virginicus L., broomsedge bluestem; J-4, G-2; O (infrequent); AFJ s.n. (9 October 2007, Old Car)

Aristida longispica Poir., slimspike threeawn; J-8, G-7; O (common); LCA 21506+, AKG 12080

Aristida oligantha Michx., prairie threeawn; J-5, G-2; O (common); LCA 21447+

Aristida purpurascens Poir., arrowfeather threeawn; J-3, G-3; O (rare); AKG 12079

Aristida stricta Michx. var. *beyrichiana* (Trin.&Rupr.) D.B. Ward, wiregrass; J-1, G-5; O (rare); LCA 21852

Arundinaria gigantea (Walter) Walter ex Muhl., switchcane; G-3; E (rare)

Bouteloua curtipendula (Michx.) Torr., sideoats gramma; G-2; O (rare); RKG 81566, AKG 11464

Dichanthelium acuminatum (Sw.) Gould & C.A. Clark subsp. *spretum* (Schult.) Freckman & Lelong (FNA 2003 vol. 25), tapered witchgrass; J-1, G-1; O (rare); AFJ 10196+

Dichanthelium bosci (Poir.) Gould & C.A. Clark (FNA 2003 vol. 25), Bosc's witchgrass; J-2, G-1; E (occasional); AFJ 10195

Dichanthelium commutatum (Schult.) Gould (FNA 2003 vol. 25), variable witchgrass; J-5, G-3; O (infrequent); AFJ #10188+

Dichanthelium dichotomum (L.) Gould (FNA 2003 vol. 25), cypress witchgrass; J-5, G-11; O (frequent); AFJ 10289+, AKG 11963

Dichanthelium oligosanthos (Schult.) Gould (FNA 2003 vol. 25), Heller's witchgrass; J-1; E (rare); LCA 21913

Dichanthelium strigosum Muhl. ex Elliott) Freckmann var. *leucocepharis* (Trin.) Freckmann (FNA 2003 vol. 25), roughhair witchgrass; G-1; O (rare); LCA 21491

Eragrostis elliottii S. Watson, Elliott's lovegrass; J-1, G-7; O (occasional); LCA 21487+

Eragrostis hirsuta (Michx.) Nees, bigtop lovegrass; J-6, G-3; O (infrequent); LCA 21448+

*Eremochloa ophiuroides** (Munro) Hack., centipede grass; J-8, G-5; O (common, disturbed areas); AFJ 10442

Gymnopogon ambiguus (Michx.) Britton et al., bearded skeletongrass; J-2; O,E (rare); LCA 21382

*Imperata cylindrica** (L.) P. Beauv., cogongrass; J-1; O (rare-disturbed areas)

*Lolium arundinaceum** (Schreb.) Darbysh., tall fescue; J-1; E (rare); AFJ 10362 [= *Schedonorus arundinaceus* (Schreb.) Dumort]

Melica mutica Walter, melicgrass; J-1, G-9; O (rare), E (frequent); LCA#21591 FSU

Muhlenbergia capillaris (Lam.) Trin. var. *capillaris*, hairawn muhly; J-7, G-10; O (common); AFJ 10278+

Panicum anceps Michx., beaked panicum; J-6, G-8; O (rare), E (occasional); LCA 21503+

Panicum capillare L., witchgrass; J-3; G-5; O (infrequent); LCA 21490+

Panicum flexile (Gatt.) Scribn., wiry panicgrass; J-6, G-10; O (common); LCA 21449+, AKG 12076

*Paspalum dilatatum** Poir., Dallisgrass; J-1, G-2; O (rare); AFJ 10295+, AKG 11037

Paspalum floridanum Michx., Florida paspalum; J-1, G-1; O,E (rare); AFJ 10491+

*Paspalum urvillei** Steud., Vaseygrass; J-2; O (rare-disturbed areas)

Piptochaetium avenaceum (L.) Parodi, needlegrass; J-3, G-2; E (rare)

Schizachyrium scoparium (Michx.) Nash, little bluestem; J-7, G-10; O (common); LCA 21462+, AKG 11897

Schizachyrium tenerum Nees, slender bluestem; J-2, G-5; O (frequent); AFJ 10280+

Setaria parviflora (Poir.) Kerguelen, yellow bristletail grass; J-9, G-11; O (frequent); LCA 21174+, AKG 10595

Sorghastrum elliottii (C. Mohr) Nash, slender indiagrass; J-3, G-2; O,E (rare); AFJ 10292+

Sorghastrum secundum (Elliott) Nash, lopsided indiagrass; G-4; O,E (rare)

Sphenopholis filiformis (Chapm.) Scribn., longleaf wedgescale; J-1; O (rare); LCA 21590

Sporobolus clandestinus (Biehler) Hitchc. (FNA 2003 vol. 25), hidden dropseed; J-7, G-11; O (common); LCA 21488+

Sporobolus junceus (P. Beauv.) Kunth, pineywoods dropseed; J-8, G-9; O (common); LCA 21446+

Sporobolus vaginiflorus (Torr. ex A. Gray) A.W. Wood, poverty dropseed; J-9, G-7; O (common); LCA 21463+, AKG 9747

Tridens flavus (L.) Hitchc., tall redtop; J-8, G-12; O (rare), E (occasional); AFJ 10444

Polemoniaceae

Phlox divaricata L., wild bluephlox; J-1, G-2; O,E (rare)

Phlox glaberrima L., smooth phlox; J-1, G-3; O,E (rare); AFJ 10208+

Phlox pilosa L., downy phlox; J-8, G-5; O,E (occasional); LCA 21902+, AKG 2827

Polygalaceae

Asemeia grandiflora (Walter) Small (Abbott 2011), showy milkwort; J-6, G-7; O (frequent); LCA 20753+, AKG 9709 (all plants seen on the glades have narrow, linear leaves) [= *Polygala g.* Walter]

Polygala boykinii Nutt., Boykin's milkwort; J-9, G-12; O (frequent); LCA 21284

Primulaceae

Primula meadia^{1,2} (L.) A.R. Mast & Reveal, shooting star; G-2; E (frequent); LCA 21857+, AKG 11580

Ranunculaceae

Delphinium carolinianum^{1,2} Walter, Carolina larkspur; J-2, G-8; O (infrequent); LCA 21865+, AKG 9813+

Thalictrum revolutum DC., waxyleaf meadowrue; J-1, G-1; E,V (occasional)

Rhamnaceae

Berchemia scandens (Hill) K. Koch, rattan vine; J-6, G-10; O (occasional), E (common); JBN 2741

Rhamnus caroliniana Walter, Carolina buckthorn; J-9, G-4; E (occasional); LCA 21195+

Rosaceae

Agrimonia microcarpa Wallr., smallfruit agrimony; J-2, G-2; E (rare); LCA 21384+

Crataegus pulcherrima Ashe (Nelson 2011), beautiful hawthorn; G-5; E (infrequent); AFJ 10512+

Crataegus spathulata Michx., littlehip hawthorn; G-5; E (common); AFJ 10452

Fragaria virginiana Duchesne, Virginia strawberry; J-3; E (rare); LCA 21206

Malus angustifolia (Aiton) Michx., southern crabapple; G-3; E (rare)

Prunus angustifolia Marshall, chickasaw plum; G-1; O (rare); AFJ 10516

Prunus caroliniana (Mill.) Aiton, Carolina laurelcherry; G-1; O (rare)

Prunus serotina Ehrh., black cherry; J-2, G-4; E (infrequent)

*Pyracantha koidzumii** (Hyata) Rehder, Formosa firethorn; J-4, G-3; O,E (occasional to frequent); AFJ#10487 FSU+

Rosa carolina L., Carolina rose; J-3, G-3; O,E (infrequent)

Rubus trivialis Michx., southern dewberry; J-1, G-2; O,E (occasional)

Rubiaceae

Diodia teres Walter, poor joe; J-3; O,E (infrequent)

Diodia virginiana L., Virginia buttonweed; J-3; O (infrequent)

Galium circaeans Michx., forest bedstraw; J-2; O (rare); LCA 20776+

Galium pilosum Aiton, hairy bedstraw; J-2; O (rare)

Stenaria nigricans (Lam.) Terrell, diamondflowers; J-9, G-11; O (common); LCA 21507+, AKG 9748

Rutaceae

Ptelea trifoliata L., wafer ash; J-1, G-5; O,E (occasional), LCA 9196

Zanthoxylum clava-herculis L., Hercules club; G-1; E,V (rare)

Sapindaceae

Acer rubrum L., red maple; G-2; E (rare)

Acer saccharum Marshall ssp. *floridanum* (Chapm.) Desmarais, Florida maple; J-1, G-12; E (common)

Aesculus pavia L., red buckeye; J-2, G-4; E (occasional)

Sapotaceae

Sideroxylon lanuginosum Michx., gum bully; J-8, G-3; E (common)

Sideroxylon reclinatum Michx., Florida bully; J-2, G-11; O (frequent), E (common)

Smilacaceae

Smilax bona-nox L., saw greenbrier; J-4, G-2; O (infrequent)

Smilax smallii Morong, Jackson vine; J-1, G-4; O (rare)

Smilax tamnoides L., bristly greenbrier; J-2; E (rare)

Solanaceae

Solanum carolinense L. Carolina horsenettle; J-1, G-1; O (rare)

Strychnaceae

Spigelia marilandica (L.) L., woodland pinkroot; G-9; O (rare), E (frequent)

Turneraceae

Piriqueta cistoides (L.) Griseb.ssp. *caroliniana* (Walter) Arbo, pitted stripeseed; G-10; O (frequent); LCA 21851

Ulmaceae

Ulmus alata Michx., winged elm; G-10; O (rare), E (common); JBN 2724

Ulmus rubra Muhl., slippery elm; J-1, G-3; E (rare); JBN 2753

Verbenaceae

Glandularia canadensis (L.) Small, rose mock vervain; J-2; E (rare-disturbed areas); RKG 80403

*Glandularia pulchella** (Sweet) Tronc., moss verbena; J-1,G-2; O (rare-disturbed areas)

*Verbena brasiliensis** Vell., Brazilian vervain; J-2, G-2; O (rare)

*Verbena rigida** Spreng., tuberous vervain; J-2, G-1; O (rare); LCA 21180

Violaceae

Viola palmata L., early blue violet; G-1; E (rare)

Viola sororia Willd., common blue violet; J-5, G-3; O,E (rare)

Viola walteri House, Walter's violet; J-2, G-7; O,E (infrequent)

Vitaceae

Ampelopsis arborea (L.) Koehne, peppervine; J-2, G-3; O,E (infrequent)

Parthenocissus quinquefolia (L.) Planch., Virginia creeper; J-5, G-2; O,E (occasional)

Vitis rotundifolia Michx., muscadine; J-1, G-4; O,E (occasional)

ACKNOWLEDGMENTS

For all-round help in all aspects of this study, we thank John B. Nelson. For sharing their expertise, we thank Guy Means for geological input, Dana Griffin III for identification of mosses and Kent Perkins for help in accessioning them at FLAS, Dan Miller for growing *Coreopsis* sp., and Al Schotz and Tom Patrick for field trips to the Alabama blackland prairies and Georgia Oaky Woods Wildlife Management Area, respectively. For use of his unpublished soils data we thank Charles Coultas; for supplemental range data we thank Steve Orzell and Edwin Bridges. For help in the field we thank Leigh Brooks, Alan Mosley, Gil Nelson, Jason Sellars, and Victor Williams, as well as the private landowners who kindly granted us access to their land. For helpful comments on the manuscript we thank Jerry Baskin, Kim Gullette, Michael Morris, and Kimberly Taylor. For use of its facilities we acknowledge Florida State University and in particular, Gary Knight of the Florida Natural Areas Inventory and Austin Mast of the R.K. Godfrey Herbarium.

REFERENCES

- ABBOTT, J.R. 2011. Notes on the disintegration of *Polygala* (Polygalaceae), with four new genera for the Flora of North America. J. Bot. Res. Inst. Texas 5(1):125–137.

- ALLISON, J.R. AND T.E. STEVENS. 2001. Vascular flora of Ketona Dolomite outcrops in Bibb County, Alabama. *Castanea* 66:154–205.
- ANDERSON, L.C. 1984. Noteworthy plants from north Florida. *Sida* 10:295–297.
- ANDERSON, L.C. 1988. Noteworthy plants from north Florida III. *Sida* 13:93–100.
- ANDERSON, L.C. 1989. Noteworthy plants from north Florida IV. *Sida* 13:497–504.
- ANDERSON, L.C. 2007. Noteworthy plants from north Florida VIII. *J. Bot. Res. Inst. Texas* 1:741–751.
- BARBOUR, M.G., J.H. BURK, AND W.D. PITTS. 1980. *Terrestrial plant ecology*. The Benjamin Cummings Publishing Company, Inc., Menlo Park, California.
- BARONE, J.A. AND J.G. HILL. 2007. Herbaceous flora of blackland prairie remnants in Mississippi and western Alabama. *Castanea* 72:226–234.
- BASKIN, J.M. AND C.C. BASKIN. 2000. Vegetation of limestone and dolomite glades in the Ozarks and midwest regions of the United States. *Ann. Missouri Bot. Gard.* 87:286–294.
- BASKIN, J.M. AND C.C. BASKIN. 2003. The vascular flora of cedar glades of the southeastern United States and its phyto-geographical relationships. *J. Torrey Bot. Soc.* 130:101–118.
- BRIDGES, E.L. AND S.L. ORZELL. 1986. Distribution patterns of the non-endemic flora of middle Tennessee limestone glades. *A.S.B. Bull.* 33:155–166.
- BRIDGES, E.L. AND S.L. ORZELL. 1989. *Evolvulus sericeus* (Convolvulaceae) in Georgia, with floristic and ecological notes. *Sida* 13:509–512.
- BRIDGES, E.L., S.L. ORZELL, AND L.C. ANDERSON. 1989. *Carex microdonta* Torr. & Hook. (Cyperaceae) new to Florida. *Sida* 13:378.
- BRODO, I. M., S.D. SHARNOFF, AND S. SHARNOFF. 2001. *Lichens of North America*. Yale University Press, New Haven and London.
- BROWN, L.E., K. HILLHOUSE, B.R. MACROBERTS, AND M.H. MACROBERTS. 2002. The vascular flora of Windham Prairie, Polk County, east Texas. *Texas J. Sci.* 54:227–240.
- BROWN, R.L. 2003. Paleoenvironment and biogeography of the Mississippi Black Belt: Evidence from insects. In: E. Peacock and T. Schauwecker, eds. *Blackland prairies of the Gulf coastal plain*. University of Alabama Press, Tuscaloosa. Pp. 11–25.
- CAMPBELL, J.J.N. AND W.R. SEYMOUR, JR. 2012. The flora of Pulliam Prairie, Chickasaw County, Mississippi. *J. Mississippi Acad. Sci.* 57:160–195.
- COULTAS, C.L. 1983. Examination of soils associated with “limestone glade communities” of western Gadsden County. Report to Florida Natural Areas Inventory, Tallahassee.
- CRUM, H.A. AND L.E. ANDERSON. 1981. *Mosses of Eastern North America*. Columbia University Press, New York.
- DIAMOND, D.D. AND F.E. SMEINS. 1985. Composition, classification, and species response patterns of remnant tallgrass prairies in Texas. *Amer. Midl. Naturalist* 113:294–308.
- DUFFEE, E.M., W.J. ALLEN, AND H.C. AMMONS. 1979. Soil survey of Jackson County, Florida. U.S. Department of Agriculture Soil Conservation Service in cooperation with the University of Florida Institute of Food and Agricultural Sciences Agricultural Experiment Stations, Soil Science Department, Gainesville.
- ECHOLS, S.L. AND W.B. ZOMLEFER. 2010. Vascular plant flora of the remnant blackland prairies in Oaky Woods Wildlife Management Area, Houston County, Georgia. *Castanea* 75:78–100.
- ERICKSON, R.O., L.G. BRENNER, AND J. WRAIGHT. 1942. Dolomitic glades of east-central Missouri. *Ann. Missouri Bot. Gard.* 29:89–101.
- FERNALD, E.A. AND E.D. PURDUM, EDS. 1992. *Atlas of Florida*. University Press of Florida, Gainesville.
- FLEPPC. 2011. www.fleppc.org. Accessed July 2012.
- FNA (Flora of North America Editorial Committee). 1993–2011 (continuing). *Flora of North America north of Mexico*. New York and Oxford. [Efloras.org](http://efloras.org). Accessed January 2013.
- FLORIDA DEPARTMENT OF AGRICULTURE AND CONSUMER SERVICES. 2004. Rule Chap. 5B-40, Florida Administrative Code, contains the “Regulated Plant Index.” Available from: Florida Department of Agriculture and Consumer Services, Division of Plant Industry, Gainesville.
- FNAI. 2010. Guide to the natural communities of Florida: 2010 edition. www.fnai.org. Accessed January 2013.
- FNAI. 2012. www.fnai.org/trackinglist. Accessed July 2012.
- FOTI, T.L. 1989. Blackland prairies of southwestern Arkansas. *Proc. Arkansas Acad. Sci.* 43:28.
- JONES, R.L., C.T. WITSELL, AND G.L. NESOM. 2008. Distribution and taxonomy of *Symphyotrichum sericeum* and *S. pratense* (Asteraceae: Astereae). *J. Bot. Res. Inst. Texas* 2:731–739.
- KUCERA, C.L. AND S. CLARK. 1957. Vegetation and soil relationships in the glade region of the southwestern Missouri Ozarks. *Ecology* 38:285–291.

- LAWLESS, P.J., J.M. BASKIN, AND C.C. BASKIN. 2004. The floristic ecology of xeric limestone prairies in Kentucky, and a comparison to limestone cedar glades and deep-soil barrens. *Sida* 21:1055–1079.
- LAWLESS, P.J., J.M. BASKIN, AND C.C. BASKIN. 2006. Xeric limestone prairies of Eastern United States: review and synthesis. *Bot. Rev.* 72:235–272.
- LEONARD, S.W. AND W.W. BAKER. 1982. Biological survey of the Apalachicola Ravines biotic region of Florida. Report to the Florida state office of The Nature Conservancy and to the Florida Natural Areas Inventory, Tallahassee.
- MACROBERTS, B.R. AND M.H. MACROBERTS. 1995. Vascular flora of two calcareous prairie remnants on the Kisatchie National Forest, Louisiana. *Phytologia* 78:18–27.
- MACROBERTS, B.R. AND M.H. MACROBERTS. 1996. The floristics of calcareous prairies on the Kisatchie National Forest, Louisiana. *Phytologia* 81:35–43.
- MACROBERTS, M.H., B.R. MACROBERTS, AND L. STACEY. 2003. Louisiana prairies. In: E. Peacock and T. Schauwecker, eds. *Blackland prairies of the Gulf coastal plain*. University of Alabama Press, Tuscaloosa. Pp. 80–93.
- MOORE, W.E. 1955. Geology of Jackson County, Florida. Bulletin No. 37, Florida Geological Survey, Tallahassee.
- MORRIS, M.W., C.T. BRYSON, AND R.C. WARREN. 1993. Rare vascular plants and associate plant communities from the Sand Creek chalk bluffs, Oktibbeha County, Mississippi. *Castanea* 58:250–259.
- MUELLER-DUMBOIS, D. AND H. ELLENBERG. 1974. Aims and methods of vegetation ecology. John Wiley and Sons, New York.
- MUNZ, P.A. AND D.D. KECK. 1959. A California flora. University of California Press, Berkeley.
- NATURESERVE. 2012. NatureServe .org. Accessed July 2012.
- NELSON, G. 2011. The trees of Florida: a reference and field guide. Second edition. Pineapple Press Inc., Sarasota, FL.
- NELSON, J.B. 1985. *Bouteloua curtipendula* in Florida. *Castanea* 40:58.
- NELSON, P. AND D. LADD. 1980. Preliminary report on the identification, distribution, and classification of Missouri glades. In: C. Kucera, ed. *Proceedings of the Seventh North American Prairie Conference*, Southwest Missouri State University, Springfield. Pp. 59–76.
- PEACOCK, E. AND T. SCHAUWECKER. 2003. The nature, culture, and sustainability of blackland prairies. In: E. Peacock and T. Schauwecker, eds. *Blackland prairies of the Gulf coastal plain*. University of Alabama Press, Tuscaloosa. Pp. 1–7.
- QUARTERMAN, E. 1950. Major plant communities of Tennessee cedar glades. *Ecology* 31:234–254.
- RUPERT, F.R. 1990. Geology of Gadsden County, Florida. Bulletin No. 62, Florida Geological Survey, Tallahassee.
- SCHOTZ, A. AND M. BARBOUR. 2009. Ecological assessment and terrestrial vertebrate surveys for Black Belt Prairies in Alabama. Alabama Natural Heritage Program, Environmental Institute, Auburn University, Auburn. Report submitted to Alabama Department of Conservation and Natural Resources, Division of Wildlife and Freshwater Fisheries, State Wildlife Grants Program, Montgomery.
- SCHOTZ, A. 2011. A checklist of the vascular flora in the Black Belt Prairies of Alabama. Alabama Heritage Program, Environmental Institute, Auburn University, Auburn.
- SIMS, P.L. 1988. Grasslands. In: M.G. Barbour and W.D. Billings, eds. *North American terrestrial vegetation*. Cambridge University Press, Cambridge. Pp. 266–286.
- SPARLING, J.T. 1968. Biological flora of the British Isles: *Schoenus nigricans* L. *J. Ecol.* 56:883–899.
- THOMAS, B.P., H.H. WEEKS, AND M.W. HAZEN. 1961. Soil survey of Gadsden County, Florida. U.S. Department of Agriculture, Soil Conservation Service in cooperation with the University of Florida Institute of Food and Agricultural Sciences, Agricultural Experiment Stations, Soil Science Department, Gainesville.
- WARD, D.B. AND A.K. GHOLSON. 1987. The hidden abundance of *Lepuropetalon spathulatum* (Saxifragaceae) and its first reported occurrence in Florida. *Castanea* 52:59–67.
- WARE, R. 2008. Pers. Comm. 2 Idlewood Court NW, Rome, GA.
- WARE, S. 2002. Rock outcrop plant communities (glades) in the Ozarks: a synthesis. *Southw. Naturalist* 47:585–597.
- WEATHER-WAREHOUSE. 2012. www.weather-warehouse.com/weatherhistory/pastweather data-mariannaschool. Accessed July 2012.
- WEAKLEY, A.S. 2012. Flora of southern and mid-Atlantic states. Working draft of 30 November 2012. University of North Carolina Herbarium (UNC), North Carolina Botanical Garden, University of North Carolina, Chapel Hill. Herbarium. unc.edu/FloraArchives/WeakleyFlora_2012-Nov.pdf. Accessed January 2013.
- WHITE, M. AND D. ARBOUR. 2012. *Symphyotrichum pratense* (Asteraceae): new for the flora of Oklahoma. *Phytoneuron* 2012-109:1–4. www.phytoneuron.net/phytoneuron2012PUBS.htm.
- WUNDERLIN, R.P. AND B.F. HANSEN. 2008. Atlas of Florida vascular plants. www.plantatlas.usf.edu. [S.M. Landry and K.N. Campbell (application development), Florida Center for Community Design and Research.] Institute for Systematic Botany, University of South Florida, Tampa. Accessed January 2013.

WUNDERLIN, R.P. AND B.F. HANSEN. 2011. Guide to the vascular plants of Florida. Third Edition. University Press of Florida, Gainesville.

ZOLLNER, D., S. SIMON, AND T.L. FOTI. 2003. A plant community classification for Arkansas blackland prairie ecosystem. In: E. Peacock and T. Schauwecker, eds. Blackland prairies of the Gulf coastal plain, University of Alabama Press, Tuscaloosa. Pp. 110–145.



Johnson, A F et al. 2013. "FLORA OF CALCAREOUS UPLAND GLADES IN GADSDEN AND JACKSON COUNTIES, FLORIDA." *Journal of the Botanical Research Institute of Texas* 7(1), 475–494.

View This Item Online: <https://www.biodiversitylibrary.org/item/236568>

Permalink: <https://www.biodiversitylibrary.org/partpdf/263548>

Holding Institution

Missouri Botanical Garden, Peter H. Raven Library

Sponsored by

Missouri Botanical Garden

Copyright & Reuse

Copyright Status: In copyright. Digitized with the permission of the rights holder.

Rights Holder: Botanical Research Institute of Texas

License: <http://creativecommons.org/licenses/by-nc-sa/4.0/>

Rights: <https://www.biodiversitylibrary.org/permissions>

This document was created from content at the **Biodiversity Heritage Library**, the world's largest open access digital library for biodiversity literature and archives. Visit BHL at <https://www.biodiversitylibrary.org>.